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REPORT NO. DPS/OAC-I/60/2

R1154/60

ARTILLERY DIVISION

REPORT ON

EVALUATION OF PREPRODUCTION SHOT, APDS, 105-MM, M392A1 FOR M68 GUN (U)

Second Report on Project OAC-I/60

R. H. ALLEN

JUNE 1960

Aberdeen Proving Ground
Maryland

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All request for additional copies of this report will be made to ASTIA, Arlington Hall Station, Arlington 12, Virginia.

AD- 317307

SECURITY REMARKING REQUIREMENTS

DOD 5200.1-R, DEC 78

REVIEW ON 28 JUN 80

5

UNCLASSIFIED

DTIC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. BFL27M

2 July 81

AD- 317 307 19/1

ABERDEEN PROVING GROUND MD

EVALUATION OF PREPRODUCTION SHOT, APDS, 105-MM, M392A1 FOR M68 GUN (U)

DESCRIPTIVE NOTE: Rept. no. 2,
JUN 60 16P ALLEN,R.H.;I
PROJ: OAC-I-60

UNCLASSIFIED REPORT C-11,698

DESCRIPTORS: *ARMOR PIERCING AMMUNITION, *HYPERVELOCITY PROJECTILES, *PROJECTILES, *SABOT PROJECTILES, MAGNESIUM ALLOYS, MECHANICAL PROPERTIES, PENETRATION, TESTS (U)
IDENTIFIERS: M-392 CARTRIDGES(105-MM), M-68 GUNS(105-MM) (U)

[redacted]

DEVELOPMENT AND PROOF SERVICES
ABERDEEN PROVING GROUND
MARYLAND

AUTHORITY: ORDBA-6151 RHAllen/jls

EVALUATION OF PREPRODUCTION SHOT, APDS, 105-MM, M392A1 FOR M68 GUN (U)

Second Report on Project OAC-I/60

Date of Test: February 1960

ABSTRACT (S)

Fifty Shot, APDS, 105-mm, M392A1 were supplied for an evaluation of armor-penetration and 1000-yard-accuracy characteristics. The shot were divided into two groups of 25 each and assembled with sabots from two different suppliers.

The defeat-of-armor phase was fired first using the stipulated shot and a 5-inch rolled homogeneous armor plate set at 60° obliquity. A protection ballistic limit of 4609 fps was obtained for the US shot, but due to the urgency of the program a protection ballistic limit was not obtained for the UK shot.

In the accuracy and metal-parts phase the shot to be fired at 70°F were assembled with experimental tracers designated XM-. Ten of the rounds were temperature-conditioned at -40°F and the other 20 were fired at 70°F in groups of ten. Acceptable accuracy was obtained with the sabots from both suppliers.

In view of the promising accuracy results obtained in this program, it is recommended that a more extensive test be fired with similarly constructed projectiles to confirm the adequacy of design and construction. Additional plate-performance tests should be conducted with both the UK and US shot to establish a valid comparison of the two rounds.

[redacted]

CONTENTS (U)

1. (S) INTRODUCTION

Previous firing of the 105-mm, APDS shot, as manufactured by the US gave positive evidence of sabot failure and/or total breakup of the sub-projectile within the tube. Investigation as to the cause of breakup revealed that tighter control was necessary over material physical properties than was implied by UK drawings and specifications.

Metal parts submitted for the current test have been manufactured in accordance with the latest technical data and advice from UK representatives. The purpose of this test is to confirm and evaluate the performance of shot produced by US production methods for the translated design.

2. (S) DESCRIPTION OF MATERIEL

The following materiel was under test:

a. Shot, APDS, 105-mm, M392A1, numbered 301 through 325, Lot FA-E-554. Sabots consist of AZ61 magnesium alloy from supplier "A".

b. Shot, APDS, 105-mm, M392A1, numbered 326 through 350, Lot FA-E-554-1. Sabots consist of AZ61 magnesium alloy from supplier "B".

Further information may be found in Appendix C (data sheet with shot characteristics).

3. DETAILS OF TEST

3.1 (U) Procedure

In this test the plate-penetration phase was fired first. A piece of armor plate was placed in the butts at the required obliquity, and following each round the plate was checked for movement and to assure the correct obliquity. As the first plate fired upon was small in area, the number of hits was limited. A larger plate with a comparable BHN and Charpy value was then used to insure a fair hit.

In the accuracy phase, ten rounds were temperaturized at the request of the arsenal representative and tracers were not assembled with these rounds. All other rounds fired for accuracy at 1000 yards were assembled with the experimental tracers. Velocities of the shot during the accuracy firings were not recorded, at the request of the arsenal representative. A smear type camera was emplaced 35 feet from

the muzzle but was not used because of inclement weather during the firing of the test. All rounds fired were assembled with the service charge as received from the UK.

3.2 (S) Results

Considering the plate-firing results of the last 10 US shot fired in L7 Tube No. L/25, a PBL of 4609 fps was obtained. Only three UK shot were fired before the plate firing was suspended at the request of the FA representative in favor of the target accuracy firing. Insufficient data were obtained with the UK shot to make a valid comparison of plate performance with the US version.

In the accuracy phase of the test, the ten rounds temperature-conditioned at -40°F were fired first followed by the remaining 20 rounds at 70°F. The results of the firing follow:

Group No.	Temperature, °F	Probable Error, mils		Range, yards
		Vertical	Lateral	
1	-40	0.12	0.08	1000
2	70	.11	.09	1000
3	70	.19	.13	1000
	Grand Average	.14	.10	

Test Round 38 in group three was an outlier and exhibited what appeared to be a tracer separation. However, no positive evidence of projectile failure could be found and it is concluded that no serious malfunction occurred.

4. (S) CONCLUSIONS

It is concluded that:

a. The current production Shot, APDS, 105-mm, M392A1 will yield satisfactory accuracy and metal-parts security if manufactured from AZ61 magnesium alloy from either supplier "A" or "B".

b. The data generated from the plate firing is not conclusive and further firing with both control and test rounds will be necessary to yield a more conclusive PBL.

5. (S) RECOMMENDATIONS

It is recommended that:

a. In view of the promising accuracy results obtained in this program it is recommended that a more extensive test be fired with similarly constructed projectiles to confirm the adequacy of design and construction.

b. Additional plate performance tests should be conducted with both UK and US shot to establish a valid comparison of the two rounds.

SUBMITTED:

Ralph A. Allen

RALPH H. ALLEN
Test Director

REVIEWED:

H B Anderson

H. B. ANDERSON
Chief, Artillery
Ammunition Branch

H. A. Bechtol

H. A. BECHTOL
Chief, Artillery
Division

APPROVED:

Arthur Noble
for

H. A. NOBLE
Assistant Deputy Director
for Engineering Testing
Development and Proof Services

APPENDICES

APPENDIX A

Correspondence

ORDNANCE CORPS
FRANKFORD ARSENAL
PHILADELPHIA 37,
PENNSYLVANIA

Mr. Psyk/sms/3177
09 FEB 1960

IN REPLY
REFER TO ORDBA-6151

SUBJECT: Cartridge, APDS-T, 105mm, M392

TO: Commanding General
Aberdeen Proving Ground
Maryland
ATTN: ORDBG-D&PS, Mr. H. Anderson

Inclosed is Test Program Request FA-IEP-59-6114-1-3 covering testing of subject cartridge. It is requested that this Arsenal be notified in advance of the test in order that a representative may be present. This Arsenal has been advised that funds to fire this program will be forwarded to Aberdeen Proving Ground by Picatinny Arsenal.

FOR THE COMMANDER:

C. W. BROWN
Assistant

1 Incl
1. TPR-FA-IEP-59-6114-1-3 (in dupe)

cc: OCO, ATTN: ORDIM w/incl
OAC, ATTN: ORDLY-AI w/incl
Pic Ars, ATTN: ORDBB-DC w/incl
APG, ATTN: ORDBG-D&PS w/incl

Test Program Request
FA-IEP-59-6114-1-3
Frankford Arsenal
Philadelphia 37, Pa.

JFPsyk/sms/3177
11 February 1960

1. Material for Test:

(a) Twenty-five (25) each Projectile, 105mm, APDS-T, M392, numbered 301 through 325. Sabots of AZ61 magnesium alloy from supplier "A", sub-numbers 1 and 3 following the basic number identify the bar from which sabots were machined.

(b) Twenty-five (25) each projectile, 105mm, APDS-T, M392, numbered 326 through 350. Sabots of AZ61 magnesium alloy from supplier "B", sub-numbers and letters following the basic number identify the bar from which the sabots were machined and the relative position in that bar.

(c) U. K. NQM propellant and L1A3 primers with approved igniters for fifty (50) rounds.

(d) Fifty (50) case cartridge, 105mm, M115

(e) U. K. tank gun, 105mm L7A1, one-quarter to one-half worn.

2. Project Authority:

DCS Log Project No. 517-FY-58 (ORD) A6-86-58-1

3. Arsenal Expenditure Order No:

XO 84525-02
XO 94639-01

4. Object of Development or Experiment:

To evaluate performance of rounds produced during U. S. Production engineering of the translated U. K. design.

5. History Sketch:

Failures encountered in previous engineering testing (ref: TPR's FA-IEP-59-6114-1-1, FA-IEP-59-6114-1-2 and PA-D-86) have indicated that a higher degree of control is required over material physical properties than implied by U. K. drawings and specifications. Review of test data and discussions with U. K. design personnel have resulted in a revision of drawings and specifications for this purpose. Metal parts to be tested under this TPR have been manufactured in accordance with this latest technical data package and are considered representative of the U. S. production of the M392 APDS-T projectile.

6. Improvement or Changes since Last Proving Ground Test:

(a) Test rounds for this TPR have been assembled with an improved nose component. Laboratory tests show this component to have mechanical properties listed as follows:

(1) Ultimate tensile 119,900 psi
(2) Hardness 32-33 R_c
(3) Compression Test ($\frac{1}{2}$"x $\frac{1}{2}$" cylinder)
Original length .501"
Length after Comp. .252" - No visible evidence of cracking after compression testing.

7. Object of this Test:

Confirmation of final technical data package.

8. Local Tests:

Mechanical Testing

Supplier "A"

(a) Bar #1

Tensile	Yield	% Elong.
44,000	27,200	16.3
43,500	26,200	16.2

(b) Bar #3

Tensile	Yield	% Elong.
42,400	26,100	14.5
42,200	24,700	15.5

Supplier "B"

	Tensile		Yield		% Elong.	
	Front	Rear	Front	Rear	Front	Rear
Bar #1	44,800	44,400	29,800	30,200	15.2	13.5
Bar #9	42,100	44,400	28,100	30,500	11.5	14.5

9. Precautions in Handling and Testing:

Normal safety precautions should be employed in handling and testing of this ammunition.

10. Recommended Test Program:

This program will be fired in two (2) phases.

Phase I - Metal Parts Security and Accuracy
Phase II - Plate penetrations capability of this design

Phase I - Metal Parts Security

(a) Fire forty (40) test projectiles, identified as 301 through 320 and 326 through 345 at a 1000 yard target at service pressure and ambient temperature.

(b) Record muzzle velocity and chamber pressure for each round.

(c) Provide a photographic record of the performance of each round by smear photographs at 10' and 30' from the muzzle.

(d) Record P. E. separately (in 20 round groups) for projectile nos. 301 through 320 and 326 through 345.

Note: Supplemental information may be recorded as determined significant by the Proof Director.

Phase II - Plate Penetration

(a) Using the ten (10) remaining projectiles (nos. 321 through 325 and 346 through 350), establish a PBL against the required thickness of homo-rolled armor plate inclined at an angle of 60° from a plane normal to the trajectory.

(b) Record muzzle velocity and chamber pressure for each round.

(c) Provide clear and sufficiently detailed photographs to show the nature of shot impact with the plate.

Note: Another plate thickness and/or obliquity may be selected by the Proof Director, if in his opinion, an advantage may be gained with respect to better formulation of a reference PBL. Reference rounds may be used if available.

11. Examination of Projectiles prior to Testing:

(a) Record projectile weights and diameters of centering bands and rotating bands.

(b) Examine each projectile for gap forward of, or at the rear of the rotating band, and between the base and the rear of the sabot.

12. References:

(a) Project Order 80304230-1-19-51751-01-0, dated 20 June 1958.

(b) AIFO #87170100-99-45250-21

13. Coordination:

Chief of Ordnance - ORDIM
Picatinny Arsenal - ORDBB-DC
Ordnance Ammunition Command - ORDLY-
Aberdeen Proving Ground - D&PS
Frankford Arsenal - 6151

APPENDIX B

Firing Record

DEVELOPMENT AND PROOF SERVICES
ABERDEEN PROVING GROUND, MARYLAND
FIRING RECORD

Evaluation of Preproduction Shot, APDS, 105-mm, M392A1 for M68 Gun (U)	Firing Record No.: P-65181 Dates of Test: 16, 17, 18 Feb 1960 Authority: Ltr dtd 9 Feb 1960 ORDBA-6151, w/TPR FA-IEP-59-6114-1-3
Project No.: OAC-I/60 Production Evaluation	W. O. No. 322-964-03 dyl

ITEMS UNDER TEST (U)

Shot, APDS, 105-mm, M392A1, Numbered 301 through 325, Lot FA-E-554.
Shot, APDS, 105-mm, M392A1, Numbered 326 through 350, Lot FA-E-554-1.

SUPPORTING FACILITIES AND MATERIALS

Ammunition (S):

All components from UK.
Primer, Electric, 467 grains, L1A3, Black Powder, Lot 3.
Case, Cartridge, 105-mm, RW-244, Lot 11P.
Propellant, N/QM, 0.044-inch web, Lot BS-23826.

Weapon (U):

Tube, 105-mm, L7A1, No. L/17 (Test Rounds 1 to 6).
Tube, 105-mm, L7A1, No. L/25 (Test Rounds 7 to 44).
Gun, 105-mm, M68, No. 4.
Recoil Mechanism, 155-mm, M3, No. 1135.
Mount, 155-mm, M1, No. 332 (for plate phase only).
Mount, Pedestal, 155-mm, No. 91 (set in concrete) for accuracy phase.

Plate Data (U):

The plate data sheet may be found in Appendix C.

Velocity Coil Measurements (U):

16 February 1960

Muzzle to first coil -	80.04 feet
Between coils -	49.59 feet
Second coil to center of plate -	109.50 feet
Velocity measured at -	103.025 feet

17 February 1960

Muzzle to first coil -	80.15 feet
Between coils -	49.645 feet
Second coil to center of plate -	108.40 feet
Velocity measure at -	104.87 feet

M3 Pressure Gage Data (U):

All rounds in plate firing assembled with two M3 gages.

Type of Gage: Medium Caliber (M3), Copper Cup.

Position of Gage: In base of case.

Crusher Cylinder: Metal of 1956, Annealed 1956, Lot 9C-56.

Initial Compression: 0

ROUND-BY-ROUND DATA (U)

Round-by-round data may be found in Inclosure 1.

REMARKS (U)

This firing record forms a part of the Second Report on Project OAC-I/60.

SUBMITTED:

Ralph H. Allen

RALPH H. ALLEN
Test Director

REVIEWED:

H. B. Anderson

H. B. ANDERSON
Chief,
Artillery Ammunition Branch

APPROVED:

H. A. Bechtol

H. A. BECHTOL
Chief,
Artillery Division

1 Incl
1. Round-by-Round Data

ROUND-BY-ROUND DATA, PLATE FIRING (S)

Tube No.	Round No. Tube	Round No. Test	Prop. Charge lb	Prop. Charge oz	Shot Type	Velocity, fps Instr	Velocity, fps Striking	Chamber Press., psi/100	Plate History Results	Plate History Front, in.	Plate History Back, in.
L/17	135	1	11	8	UK	4381	4369	398	Partial	$2\frac{1}{2}$ x 11 x 4	$1\frac{1}{2}$ Bulge
	136	2	12	0	UK	Lost	Lost	410	Partial	3 x $11\frac{1}{2}$ x $4\frac{1}{2}$	2-3/4 with crack
	137	3	12	1	UK	Lost	Lost	416	Partial	3 x 11 x $4\frac{1}{2}$	$2\frac{1}{2}$ Bulge
	138	4	12	1	US	4723	4711	458	Complete		
	139	5	12	1	US	4741	4729	463	Complete		
	140	6	12	1	US	4750	4738	472	Complete		
L/25	5	7	11	8	US	4534	4522	431	Partial	3 x 11 x $3\frac{1}{2}$	3/4 Bulge
	6	8	11	10	US	4657	4645	456	Complete		
	7	9	11	8	US	4644	4632	453	Partial	3 x 11 x 5	2-3/4 with crack
	8	10	11	9	US	4627	4615	458	Partial	3 x 12 x $4\frac{1}{2}$	$2\frac{1}{4}$ Bulge
	9	11	11	10	US	4631	4619	442	Complete		
	10	12	11	7	US	Lost	Lost	427	Partial	$2\frac{1}{2}$ x $10\frac{1}{2}$ x $4\frac{1}{2}$	2 Bulge
	11	13	11	8	US	4601	4594	429	Partial	3 x $10\frac{1}{2}$ x $4\frac{1}{2}$	$2\frac{1}{4}$ Bulge
	12	14	11	8	US	4567	4550	426	Complete		

SECRET

ROUND-BY-ROUND DATA, ACCURACY FIRING AT 1000 YARDS (S)

Round No. Tube	Round No. Test	Shot No.	Temperature Fired, °F	Target Coordinates inches Vertical	Target Coordinates inches Lateral
13	15	331-1-L	-40	∤41	∤36
14	16	333-1-N	-40	∤36	∤35.5
15	17	334-1-P	-40	∤35	∤27.5
16	18	330-1-K	-40	∤33	∤29.5
17	19	332-1-M	-40	∤32.5	∤27.5
18	20	328-1-I	-40	∤29.5	∤32.5
19	21	329-1-J	-40	∤26.5	∤26.5
20	22	347-1-T	-40	∤25	∤32.5
21	23	326-1-F	-40	∤21	∤36.5
22	24	327-1-G	-40	∤22	∤37.5
	Probable Error, mils			Vertical .12	Horizontal .08
23	25	309-1	70	∤18	-13
24	26	317-3	70	∤14.5	-14
25	27	303-1	70	∤18	-15
26	28	318-3	70	∤18	-15.5
27	29	302-1	70	∤16	-22.5
28	30	335-1-Q	70	∤22	-22.5
29	31	312-3	70	∤ 6	-16.5
30	32	346-1-R	70	∤ 6	-25.5
31	33	313-3	70	∤10	-23.5
32	34	339-9-Q	70	∤ 7	-13.5
	Probable Error, mils			Vertical .11	Horizontal .09
33	35	343-9-L	70	- 5.5	-26.5
34	36	340-9-P	70	- 7	-35.5
35	37	301-1	70	- 6	-33
36	38	341-9-N	70	-29	-41
37	39	306-1	70	-16	-32
38	40	338-9-R	70	- 6	-38
39	41	304-1	70	-27	-39
40	42	337-9-T	70	-28	-21
41	43	305-1	70	-27	-22
42	44	342-9-M	70	-23	-34
	Probable Error, mils			Vertical .19	Horizontal .13

Distance muzzle to center of target 2,963.84 feet
Boresight elevation 3.1 mils
Superelevation 3.9 mils

1
Page 2

APPENDIX C
Ammunition Data

SHOT CHARACTERISTICS	SECURITY CLASSIFICATION (If any)
FILE NO.	SUBJECT 105 M/M M392A1

TO FA-E 554 FROM DATE February 15, 1960 COMMENT NO. 1

#	Weight	Dia. of R. Band	Conc. of R. Band	4.125-005 Con.-.004 Dia. of Centering Band
	12.81			
301-1	12.71	4.263	.004	OK
302-1	12.7	4.267	.007	OK
303-1	12.72	4.27 to 4.273	.003	OK
304-1	12.72	4.269 to 4.273	.005	4.119
305-1	12.72	4.265	.0035	OK
306-1	12.72	4.265	.003	OK
309-1	12.7	4.269 to 4.270	.001	OK
312-3	12.74	4.270 to 4.271	.001	OK
313-3	12.72	4.270	.007	OK
317-3	12.71	4.270 to 4.2715	.006	OK
318-3	12.73	4.267	.008	OK
319-3	12.72	4.265	.004	OK
320-3	12.75	4.267	.004	OK
321-1	12.72	4.263	.0035	OK
322-1	12.71	4.265	.004	OK
325-1	12.72	4.268	.005	OK
FA-E- 554-1				
326-1-F	12.72	4.266	.002	OK
327-1-G	12.72	4.266	.0025	OK
328-1-I	12.72	4.264	.002	OK
329-1-J	12.71	4.265	.0035	OK
330-1-K	12.7	4.263	.002	OK
331-1-L	12.68	4.266	.001	OK
332-1-M	12.72	4.263	.003	OK
333-1-N	12.72	4.270	.002	OK
334-1-P	12.72	4.265	.0035	OK
336-1-Q	12.72	4.265	.002	OK
337-9-T	12.72	4.266	.003	OK
338-9-R	12.73	4.263	.004	OK
339-9-Q	12.72	4.265	.004	OK
340-9-P	12.72	4.265	.003	OK
341-9-N	12.73	4.263	.004	OK
342-9-M	12.72	4.263	.003	OK
343-9-L	12.72	4.265	.002	OK
344-9-K	12.73	4.264	.001	OK
345-9-J	12.71	4.269	.005	OK
346-1-R	12.71	4.267	.004	OK
347-1-T	12.7	4.265	.002	4.115
348-1-U	12.72	4.265	.006	4.119 to 4.120
349-9-H	12.71	4.265	.004	OK
350-9-G	12.7	4.264	.002	OK

ORDNANCE CORPS
AMMUNITION DATA CARD AND
LOT DESCRIPTION SHEET

ARSENAL, PLANT, OR DISTRICT	NET QUANTITY	LOT NUMBER
Frankford Arsenal	474	FA-E-554

ITEM

Projectile 105-mm M382A1 - APDS-T

CONTRACT ORDER NO.
*

CONTRACTOR	DRAWING AND REVISION	SPEC. AND REVISION
Frankford Arsenal	F-8595461 REV A	MIL-G-2550

DATE STARTED	DATE COMPLETED	DATE INSPECTED
February 1960	February 1960	February 1960

SENT TO	DATE SENT
Aberdeen Proving Ground, Md.	February 1960

COMPONENT	DRAWING NO.	MODEL
Component Parts Manufactured by F. A.	to Dwg.	
Sheath Forward	D-8595474	A
Sheath Rear	D-8595477	A
Cup	C-8595466	A
Base	D-8595475	A
Sabot	D-8595476	A
Rotating Band	C-8595469	A
Centering Band	C-8595470	A
Plug & Disc Assembly	C-8595462	A
Core	C-8595471)	Manufactured by Kennametal Inc.
Nose	C-8595472)	

*FY 59, WD 97110100-99-60200
FAXO-94622-01-50 12 February 1960

DISPOSITION	INSPECTOR'S SIGNATURE AND TYPED NAME
Finally Accepted	/s/ R. W. Anderson /t/ R. W. ANDERSON

Obturator	C-8595473	Castile Rubber Co.

Remarks:
* Packing of Lot ----Projectiles will be packed on Pallets not to exceed 50 each. Pallet may contain lesser amts. Pending on Total Quantity shipped.

ORDNANCE CORPS
AMMUNITION DATA CARD AND
LOT DESCRIPTION SHEET

ARSENAL, PLANT, OR DISTRICT	NET QUANTITY	LOT NUMBER
Frankford Arsenal	26	FA-E-554-1

ITEM

Projectile 105-mm M382A1 - APDS-T

CONTRACTOR	DRAWING AND REVISION	SPEC. AND REVISION
Frankford Arsenal	F-8595461 REV A	MIL-G-2550

DATE STARTED:	DATED COMPLETED	DATE INSPECTED
February 1960	February 1960	February 1960

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Sheath Rear	D-8595477	A
Cup	C-8595466	A
Base	D-8595475	A
Sabot	D-8595476	A
Rotating Band	C-8595469	A
Centering Band	C-8595470	A
Plug & Disc Assembly	C-8595462	A
Core	C-8595471)	Manufactured by Kennametal Inc.
Nose	C-8595472)	

*FY 59, WD 97110100-99-60200
FAXO-94622-01-50 12 February 1960

DISPOSITION	INSPECTOR'S SIGNATURE AND TYPED NAME
Finally Accepted	/s/ R. W. Anderson /t/ R. W. ANDERSON

Obturator	C-8595473	Castile Rubber Co.

Remarks:
*Projectiles made of Alcoa Magnesium - packed with Lot FA-E-554 on pallets.

Form OROMX-1
21 Dec 49 3983

ARMOR DATA CHECK SHEET
SIP-12

ORDNANCE DEPARTMENT
DETROIT ARSENAL

MFG. RECORD NO. 929002	PRIMARY CONTRACTOR	FIRING RECORD NO.
MFG. The Midvale Company	The Midvale Company	FIRING DATE
ADDRESS Philadelphia, Pa.	CONTRACT	SPECIFICATION 57-115-18 REVISION 11/16/49 AMENDMENT
MFG. DATE	DA-18-001-ORD-2625	TYPE ARMOR: CAST X HOMO ROLLED X FH FORGED
SHIPPED TO Aberdeen, Md.	ORDNANCE DISTRICT (OR ARSENAL)	FURNACE: X OH BASIC X ELECT. ACID
SHIPPED VIA: X FRT EXP TRK	Phila. Regional Office for Aberdeen Proving Ground	STEEL SOURCE The Midvale Company
PURPOSE: X ACC QUAL DEV		MATERIAL FOR USE ON
SAMPLE: X PRIMARY RETEST CASTING		
REPRESENTS: LBS.		
CASTING NO. B-5689		

CHEMICAL COMPOSITION

	C	Mn	Si	S	P	Cr	Ni	Mo	
1	.31	.44	.28	.010	.015	1.53	3.60	.36	
2									
3									

STEEL MILL FRACTURE DATA

LOCATION	1ST INGOT	MID. INGOT	LAST INGOT
TOP			
MIDDLE			
BOTTOM			

HEAT TREATMENT

	CARBURIZE		HOMOGENIZE		NORMALIZE		HARDEN		DRAW		
	TEMP	TIME	TEMP	TIME AT TEMP	TEMP	TIME AT TEMP	TEMP	TIME AT TEMP	TEMP	TIME AT TEMP	COOLANT
1			600	5 hours	1400	12 hours	1540	12 hours	1180	12 hours	water
2			1300	12 hours			1170	15 hours			

	HEAT NO.	INGOT	SLAB	PLATE NO.	THICK	SIZE	REQ BHN	ACTUAL BHN	HEAT TREATED FRACTURE
1	B-5689			14140-1	5"	72x72	240	255-241	
2								241-241	
3									

PHYSICAL PROPERTIES

CHARPY

	TEMP FT LBS	TS psi	YP psi	ELON % 2"	RA %	Room Temperature			
AM 1	36.0 CM 52.5	117500	101000	24.2	64.7	AM1	55.0	CM1	60.0
AM 2	37.0 CM 52.0	119000	99000	24.0	66.4	AM1	53.0	CM1	59.0
AO 3	52.5 CO 67.5	116000	100500	27.0	70.9	AO1	60.5	CO1	69.0
AO	53.5 CO 68.0	120500	103000	26.0	69.1	AO1	63.5	CO1	65.0

REMARKS

Sonntag Universal Impact Machine Inspector-in-Charge The Midvale Company

BALLISTIC TEST RECORD

	TEST	PROJECTILE	OBL.	THKS.	REQD. VEL.	ACT. VEL.	RESULT	REMARKS
1								
2								
3								

PROOF FACILITY SIGNATURES

To be filled in on typewriter (carbon backed) or by hand using India Ink (for reproduction).

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